Ancient bones: From simians to *sapiens*

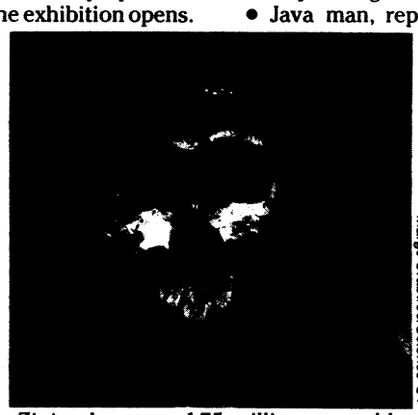
You could call it the ultimate family tree. This painstaking investigation of ancestral roots, however, does not revolve around a founding father such as Kunta Kinte; it evolves through species representatives such as the Taung child and Java man.

These two specimens and about 50 other fossils that form the backbone of evolutionary theory will be brought together for the first time in an exhibit called "Ancestors: Four Million Years of Humanity" at the American Museum of Natural History in New York City. It will run from April 13 through September 9.

Since most of the fossils have never left their home institutions and are usually kept under lock and key, this will also be the first time scientists can compare originals side-by-side. At least 60 paleoanthropologists from around the world will study the bones in early April before they are installed in their exhibit cases. The scientists will present their preliminary findings in a symposium several days before the exhibition opens.

Up until now, the delicate fossil remains have been compared by using plastic replicas, photographs, drawings and notes.

When American Museum officials first discussed organizing the exhibition in 1980, they did not know if they could pull it off. The specimens are fragile and are considered national treasures in their home countries. Most have never been publicly displayed.



Margo Crabtree/Science '84

Zinjanthropus, a 1.75-million-year-old skull discovered in 1959.

At present, the curators of 25 institutions in 13 countries have agreed to transport their fossils to the exhibition. They were persuaded, in large part, by the American Museum's careful plans for packing the specimens and for security in New York. Display cases will be designed using casts of each fossil. The curators will bring the originals over and supervise their installment just prior to the exhibition opening.

The American Museum estimates it will cost $500,000 to set up the fossil display.

The bones stretch back in time to a 30-million-year-old primate that is close to the common ancestry of humans and apes. Each major period of human development is represented: early humans or *australopithecines,* early advanced humans such as *Homo habilis* and *Homo erectus,* later advanced humans usually placed in *Homo sapiens,* Neanderthals and modern humans or *Homo sapiens sapiens.*

The collection of human ancestors includes:

- The Taung child, a 2-million-year-old partial skull of a 6-year-old child that belongs to the species *Australopithecus africanus.* Anthropologist Raymond Dart saw this fossil on the desk of a South African lime-mining supervisor in 1924 and realized it was an early human, not an ape.
- The Zinjanthropus skull, uncovered 25 years ago at Olduvai Gorge in Tanzania by Louis and Mary Leakey. The layers of earth in which it was found were dated at 1.75 million years old, doubling the known time scale of human evolution. The fossil is an *Australopithecus boisei,* younger than *A. africanus* and more heavily built with larger chewing teeth. *A. boisei* became extinct about 1.6 million years ago.
- Java man, represented by a skull cap and leg bone, and thought by its discoverer, Eugene Dubois, to be the missing link between humans and apes. This specimen was found in Indonesia in 1894 and is now known to be an early advanced human called *Homo erectus.*
- Neanderthal specimens from France, Germany, Yugoslavia and Israel. Generally regarded as an archaic form of *Homo sapiens,* they lived from 150,000 to 30,000 years ago. The exhibit includes the first Neanderthal specimen, unearthed in Germany's Neander Valley in 1856.

Conspicuous in its absence is "Lucy," the partial skeleton uncovered in Ethiopia in 1977 by Donald C. Johanson, now of the Institute of Human Origins in Berkeley, Calif., and co-workers. Richard Leakey, curator of the National Museum of Kenya, decided not to ship his fossils, which include Lucy, to New York. The exhibition will include, however, a plastic replica of the controversial remains, says an American Museum spokesperson.

Scientific debate continues over whether Lucy and related fossils are a single species of early humans called *Australopithecus afarensis,* are two distinct species, or are members of *A. Africanus* (SN: 7/2/83, p. 8). —*B. Bower*

Hemoglobin bridge boosts O_2 delivery

By slightly altering the chemistry of hemoglobin, the oxygen-carrying workhorse of red blood cells, scientists at Columbia University in New York City have developed a substance they think could boost oxygen delivery to patients after major injury, or during low-temperature heart surgery. The substance might also be useful in preserving organs that are being prepared for transplantation, they say.

Ruth and Reinhold Benesch, in collaboration with Lubos Triner, pumped their modified hemoglobin through rabbit hearts and found that the protein relinquished 10 times more oxygen to the tissue than normal hemoglobin, thereby helping to preserve the functioning of the heart as measured by the muscle's ability to contract. The key to the success of their compound is a specific chemical bridge they created between two of hemoglobin's four subunits. The finding in rabbits, soon to be published in the PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, confirms a decade of test tube experiments. The results might prove valuable as a temporary "blood substitute," in some surgery or trauma patients, Reinhold Benesch told SCIENCE NEWS. In contrast to whole blood, the modified hemoglobin continues to unload significant amounts of oxygen even at low temperature (10°C), prompting the researchers to suggest their substance could be valuable in major heart surgery when the body is substantially cooled temporarily to stop the pumping organ.

The term "blood substitute" can be misleading; blood is made up of many components that play a variety of important roles in the body, from fighting infection to conveying chemical messages from organ to organ, and no artificial substance can substitute in all those roles. But during acute bouts of heavy bleeding, a substitute liquid that can transport oxygen from lungs to outlying limbs can temporarily stretch a limited blood supply. Emulsions of fluorocarbons in saline have been shown to be effective in patients in Japan and the United States (SN: 8/28/82, p. 137), but such solutions are not problem-free, says blood researcher Anthony Hunt of the University of California at San Francisco. Recent research has indicated that the fluorocarbon solutions may depress a transfused patient's immune system, increasing susceptibility to infection, Hunt says.

Pure hemoglobin molecules, extracted from red blood cells, might seem an ideal transport alternative because they lack the troublesome proteins that trigger transfusion reactions in patients receiving the wrong type of whole blood. They also are smaller than red blood cells, the better to glide quickly through tiny capillaries.

But in practice, free hemoglobin molecules break into two, and sometimes four pieces when injected into the bloodstream without their red cell shell, and lose their ability to relinquish oxygen at the appropriate time. Several other research teams have developed alternative methods of cross-linking hemoglobin, in an effort to keep the molecule from falling apart, but most methods are not specific enough, says Reinhold Benesch. The resulting polymers vary too much in size and shape to be useful in oxygen transport, he says.

Hunt points out that some important physiological questions remain before the Beneschs' compound is ready to be tested in humans, such as how it is broken down and how it is regarded by the immune system. Nonetheless, the work adds to accumulating evidence that modified hemoglobin may prove quite useful, he says.

"It's beginning to look," Hunt says, "like a modified hemoglobin may be the best candidate for an oxygen transporting system." *—D. Franklin*

New fluoride study

Since 1959, fluoride emissions from the Reynolds Metals aluminum plant on the Gulf of St. Lawrence in Messina, New York, have rained down on Canada's tiny Cornwall Island, a part of the St. Regis Akwesasne Indian Reserve in the gulf. After the cows got sick, the bees left and pine trees started dying (SN: 7/19/80, p. 42), the island's several thousand residents began asking what might be happening to themselves. Results from a study seeking answers to that have just been released. Though "no indication of clinical illness was found to be associated persuasively with fluoride exposure," the 400-page report by Irving Selikoff and colleagues at Mt. Sinai School of Medicine in New York does recommend continued monitoring of those with high blood-fluoride levels.

While not alarmed by the study's findings, F. Henry Lickers, environmental director for the Mohawk reserve, says "We don't believe [the study is] a clean bill of health either." He says 40 or 50 islanders were found to have abnormally high fluoride levels in their blood. Another 17 symptoms — primarily respiratory, endocrinological and neurological—were positively correlated with the island's highest fluoride-exposure group, as were unusual blood-chemistry findings.

"[Mohawk] Chief Lawrence Francis has said that he doesn't believe our people should be guinea pigs to industry," Lickers told SCIENCE NEWS. Rather than studying the community for another 30 years, "We'd prefer the [Reynolds] plant be cleaned up." In 1980, the Mohawks filed suit against Reynolds seeking to force just that. And since the release of the Mt. Sinai study, Canadian officials have pledged to renew discussions with the U.S. government to resolve the pollution problem. □

Restrictions in DOD-university contracts

The fine print in research contracts between universities and the Department of Defense (DOD) has been a growing concern to many of the major research universities in the country. Especially worrisome are DOD requests for controls on publication and foreign participation in research that DOD labels as "sensitive." Yet, at the same time, university officials are faced with a rapid increase in DOD funding for university research.

For DOD, the issue is a matter of restricting the flow of sensitive technology to the Soviet Union (SN: 2/25/84, p. 117) while promoting research within the United States. "We want to slow them down and speed us up," a DOD official said recently. For university researchers, however, it means carefully considering what restrictions they are willing to accept in contracts with DOD.

The problem surfaced recently at Cornell University in Ithaca, N.Y. Cornell was unable to negotiate a contract with the U.S. Air Force because the proposed agreement contained publication restrictions and required DOD approval before any foreign national could work under the contract or gain access to data generated by the research. Cornell's Robert Barker, in a recent letter to John C. Crowley of the Association of American Universities in Washington, D.C., wrote, "In essence, we would have been required to perform secret research to be able to accept the contract under the conditions required by the agency."

Cornell electrical engineer Lester F. Eastman explained the other side of the dilemma. "This contract is quite important to me and my students," he said. "We have a patent disclosure submitted at Cornell on the device, and we have been pursuing it on a low budget for over two years. The support money in the contract [would have been] substantial—over $450,000 total for the three years."

The topic of restrictions in DOD-university contracts was debated at great length last week in Washington, at a meeting of the DOD-University Forum's Working Group on Export Controls. Although the group, with representatives from DOD and several prominent universities, has been meeting for about two years, last week's meeting was the first held in public.

Current DOD proposals call for research to be designated "sensitive" or "nonsensitive." In the case of nonsensitive research, the investigator may submit anything for publication as long as the material is sent to DOD for review at the same time. If a particular area of basic research is designated sensitive, the investigator must allow 60 days for DOD to review the paper and suggest any changes. However, the investigator is still free to ignore the suggestions.

The category that has aroused the most controversy comprises the small portion of papers that falls under the "sensitive applied research" designation. DOD would like 90 days to study these papers and the power to stop publication.

The university representatives made it clear that universities would be very unlikely to accept DOD controls on publication. David A. Wilson, representing the University of California, said, "It's a mistake to expect any university to sign a contract that yields the right of approval." Instead, he suggested, DOD should rely on the "voluntary willingness" of researchers to protect sensitive information.

Gerald J. Lieberman of Stanford University noted that many university faculties have longstanding policies on refusing secret research and contracts with publication restrictions. He contended that Stanford and other major research universities faced with this situation would simply stop doing research for DOD. Edith W. Martin, deputy undersecretary of defense for advanced technology, replied, "How much money is Stanford willing to give up?"

Lieberman also pointed out that the government has always had the right to classify research papers as secret. DOD could still use this power, if necessary, during the 90-day review period. He suggested that only in the rare instances when the researchers and DOD disagree would the power of classification have to be exercised. "The frequency is so negligible it won't be an issue," Lieberman said. For this reason, a DOD "right of approval" does not have to be specified in a contract, he said.

Martin said she prefers a more constructive, less adversarial approach that would not "make the government an ogre." In addition, she said, classification is inappropriate for protecting work "on fleeting areas of research that are sensitive for a short time." At the moment, DOD has no system in place for effectively controlling this "sensitive" research. Previous controversial moves to impose controls at scientific conferences (SN: 4/2/83, p. 218), for example, were "actions in the absence of policies and procedures," Martin said.

After the discussion, Wilson commented that although considerable progress had been made, there was "some distance to go yet." The working group decided to work out an alternative wording for the DOD proposals that would be more acceptable to universities. This new draft may be ready for discussion at a meeting of the entire DOD-University Forum next month. *— I. Peterson*